



Acquisition Research Program:
Creating Synergy for Informed Change

Design Agents: A Post-Acquisition Reform Cost-Benefit Analysis

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Design Agents: Overview

- **Introduction**
- **Survey of Literature**
- **The Phenomenon: Buildup and Demise**
- **The Programs & the Research Questions**
- **Quantitative Analysis**
- **Qualitative Analysis**
- **Findings**
- **Recommendations**



Design Agents: Introduction

- By definition, they perform during *early* part of acquisition lifecycle (SD&D). Roles include:
 - Requirements Generation
 - Technology Development
 - Systems Integration
 - Other (Source Selection, Supply Chain Management, Testing, Validation)
- “Design Agent” sometimes synonymous with “Lead Systems Integrator”
- ... all premised on the notion that Industry is more efficient, performing traditionally (but not inherently) Governmental functions



Design Agency & Acquisition Reform: Changing Climate

- **Post-Cold War: Dramatic DoD budget cuts**
- **Resource scarcity -> Reforms of 1990s**
- **FARA of 1996 – host of competing values (Efficiency vs. Fairness, Accountability, Transparency)**
- **Ten Years Later: Political / Regulatory Climate Changes**
- **Public-Private Sector Dynamics**

Where are we now? Who's really in charge?

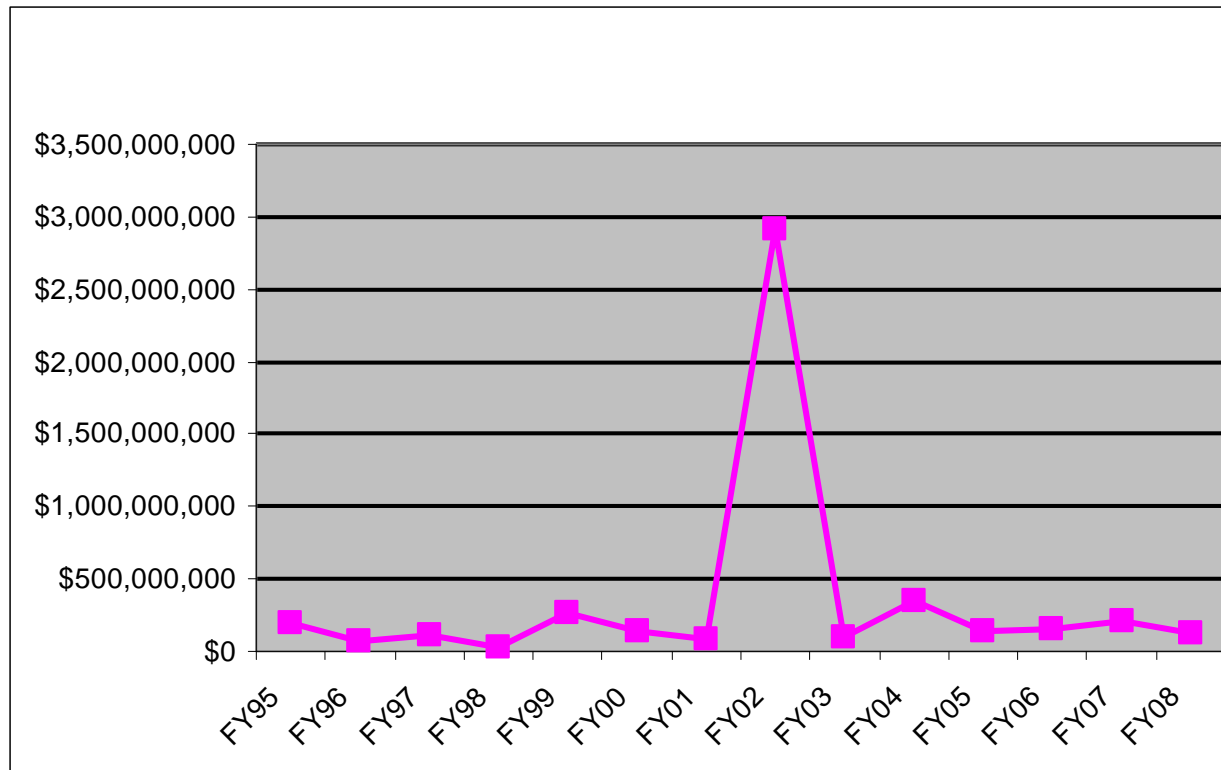


Survey of Literature and Theory

- **No Rigorous Analyses of Design Agency...yet!**
- **Contracting Out Debate (Goodsell, 2007; Globerman & Vining, 1996; Smith & Smyth, 1996; Miles & Snow, 1992)**
- **Demanding Customer and the “Hollow Organization” (Crawford & Krahn, 1998; Rickover, 1962)**
- **Lead Systems Integrator (Army’s Future Combat System – Flood & Richard, 2005)**
- **Large-Scale Systems Integration (Baron, 2007)**
- **Besal & Whitehead (2001): Contractors in T&E**



Design Agent Contracts: Dollar Value Climaxed in 2002 with DD(X) ~\$3B



Source: <http://www.defenselink.mil/contracts/archive.aspx>



Design Agent Contracts: Prevalence

- **1995-2001:** Dozens of announcements for Design Agent work (Mk41 VLS, AN/SQS-89, PFG-2, Mk15 CIWS, CEC)
- **2002:** Phenomenon climaxed with ~\$2.9B Design Agent contract award for DD(X)
- **2003-2008:** Purity of Design Agent work increasingly suspect (DDG-51 class services, etc.)



Design Agent-Led Programs: Mk 41 VLS



Photo: Global Security.org

Lockheed Martin: Design Agent for software, systems engineering and integration of Mk 41 Vertical Launching System.

United Defense Limited Partnership (now BAE Systems): Design Agent for structural and mechanical portions, VLS canisters.

> \$91M in contract awards



Design Agent-Led Programs: Trident Missile



Charles Stark Draper Lab

Design Agent for MK-2, MK-3, MK-5,
and MK-6 guidance test equipment

>\$276M in contract awards (FY95\$)

Photo: Massachusetts Institute of Technology



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Design Agent-Led Programs: Mk 53 DLS



Photo: U.S. Navy

Sippican (now Lockheed Martin)

Hardware, Software, Systems Engineering
& Design Agent services for Mk 53 Decoy
Launching System.

>\$5M in contract awards (FY01\$)



Design Agent-Led Programs: Mk 92 FCS



Lockheed Martin

Design Agent Engineering & Tech Support
for Mk 92 Fire Control System.

>\$43M in contract awards (FY06\$)

Photo: GlobalSecurity.org



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Design Agent-Led Programs: CIWS



Raytheon

Engineering & Design Agent Services for Mk 15 PHALANX Close-In Weapon System.

> \$16M in contract awards (FY99\$)

Photo: Defense Industry Daily



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Design Agent-Led Programs: SM-2



Photo: U.S. Navy

Raytheon

Design Agent services and test equipment for Standard Missile 2.

> \$65 million in contract awards



Design Agent-Led Programs: CEC



Photo: U.S. Navy

Raytheon

Design Agent to support existing Cooperative Engagement Capability baselines, equipment and computer program installations at Raytheon's engineering labs, land-based test sites, Navy field activities, Fleet assets and other Government assets.

> \$200 million in contract awards



Design Agent-Led Programs: Nuclear Subs



Photo: U.S. Navy

Electric Boat (now General Dynamics)

Design Agent services for submarines and shore facilities.

> \$800 million in contract awards



Design Agent-Led Programs: DD(X)



Art: DDG1000.com

Ingalls Shipbuilding (now Northrop Grumman)

Agent for the design, build and test of engineering development models for major subsystems and components for the DD(X) class of destroyers. Note: When program transitioned to Detail Design Integration phase, acquisition strategy changed.

> \$2.9 Billion in contract awards (FY02\$)



Design Agent-Led Programs: Carriers (Ship Alts & Logistics)

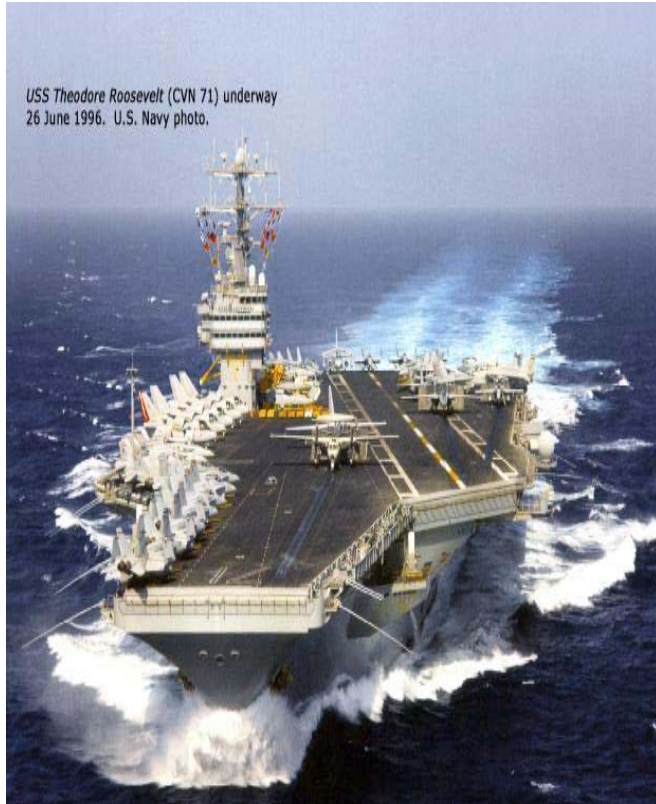


Photo: U.S. Navy

Newport News (now Northrop Grumman)

Design Agent for ship alteration and logistics support packages.

> \$20 million in contract awards (FY04\$)



Design Agents: Research Questions

- **Has the Design Agent phenomenon driven up acquisition costs for DoD programs?
(Quantitative Analysis)**
- **Have Design Agent initiatives generally weakened DoD's ability to coordinate and control its major programs?
(Qualitative Analysis)**



Design Agent vs. Navy-Led: Programs Studied

Cooperative Engagement Capability (Raytheon)

- Hardware and software
- System of sensors

Virginia-Class Submarines (Electric Boat)

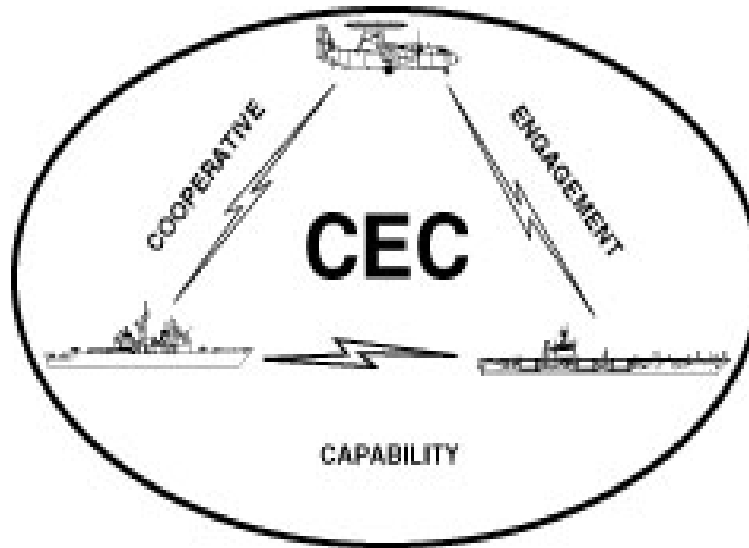
- System of systems

Arleigh Burke Destroyers (Navy)

- System of systems



Cooperative Engagement Capability



Recurring SCN estimates range from \$6.586M to \$11.23M

Raytheon performed Design Agent role; however...

Naval Surface Warfare Center Dahlgren was Software Support Activity and *Systems Engineering/Integration Agent.*

Johns Hopkins University Applied Physics Lab was Technical Direction Agent, *developing specs and prototyping systems.*



Virginia-Class Subs

Recurring SCN estimates of \$1.9B (FY05\$) were based on two ships per year and joint-production efficiency.

Actual Average Unit Production Cost of ~ \$2.3 billion (FY05\$) were driven by long production breaks and quantity of one ship per year.

Electric Boat (GD) was Design Agent; Northrop Grumman was alternate shipbuilder.



Arleigh Burke Destroyers (DDG 51)



Photo: U.S. Navy

First Ship was ~ \$1.1B (FY85\$)

AUPC for Follow Ships ~ \$900M (TY\$)

Volatility driven by cost-quantity relationships, as well as industrial base concerns and program interdependencies (delay of DD-21; alignment of LPD-17).

Strong Navy leadership steered DDG-51 to long-term success.

Navy was Design Agent; Lockheed Martin was Combat Systems Integrator.

Bath Iron Works & Ingalls: Shipbuilders.



Design Agents: Case Studies

- **Cooperative Engagement Capability:** Ongoing development & improvement (~20 years) overseen by well-balanced team.
- **Virginia Class:** Cost overrun driven by cost-quantity relationship and schedule dynamics.
- **Arleigh Burke Class:** Conscientious balancing of cost-quantity relationship and program interdependencies by Navy leaders.



Design Agents: Findings

- **Cost comparisons of “Design Agent”-led programs to traditional DoD-led programs are difficult, as roles often transcend labels.**
- **Cost comparisons of Military / civilian / contractor personnel are straightforward, but must be understood in (qualitative) context.**
- **Cost-sharing arrangements (Facilities, Software) as well as intra-Government transactions (GFE/GFI) must be clearly understood.**



Design Agents: Findings

- Delegation of leadership responsibility puts the Navy's technical competence and program-management capacity at risk.
- Pressured by profit watchers, industry may sacrifice quality to meet schedule and cost goals.
- Poor progress is often discovered too late.
- Concentration of industry power
 - Stifles innovation / erects firewalls
 - Decreases diversity of subcontractors
 - Compromises fair business practices

Best arrangements balance power among FFRDCs, Industry, and Government entities.



Recommendations

“...another order of attenuation is reached when contractors do all the managing related to the mission.”

– Goodsell, 2007

- **Boost Government role throughout development**
- **Rebalance risk and rewards for all**
- **Re-invent the Navy’s personnel system**
- **Re-ignite competitive zeal**



Concluding Thoughts...

- **Continue to weigh costs and benefits, as market forces influence opportunities for competition, expansion of supplier base, and as regulatory changes create new dynamics.**
- **Stay tuned to political feasibility & public trust issues, as well as evolving norms for business practices in times of war.**
- **The policy cycle never ends!**

